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(56) Documents Cited

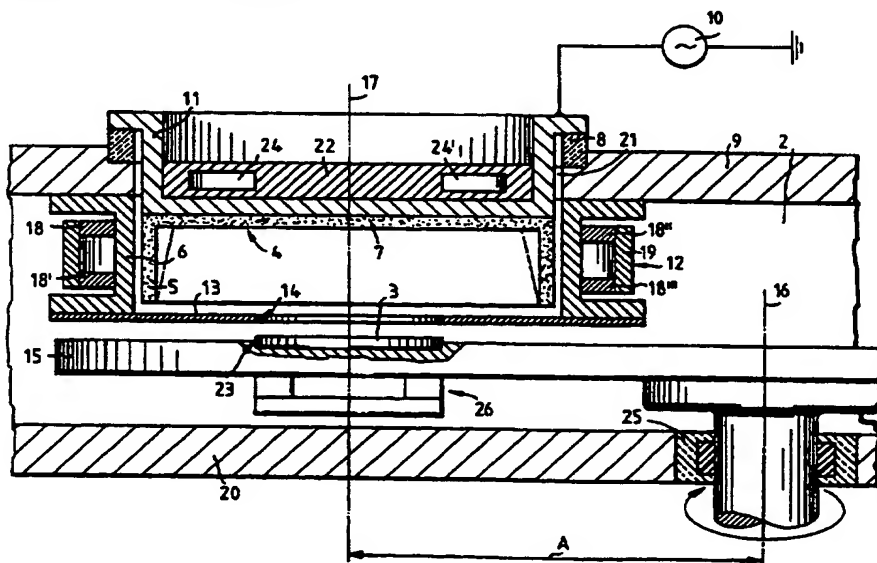
**GB 2157715 A EP 0612097 A1 US 5423971 A**

(58) Field of Search

**UK CL (Edition O ) C7F FCAS FCAV FEAB , H1D DGQ  
INT CL<sup>6</sup> C23C 14/34 14/35 , H01J 37/34 , H05H 1/46  
Online: WPI**

## (54) Cathode sputtering

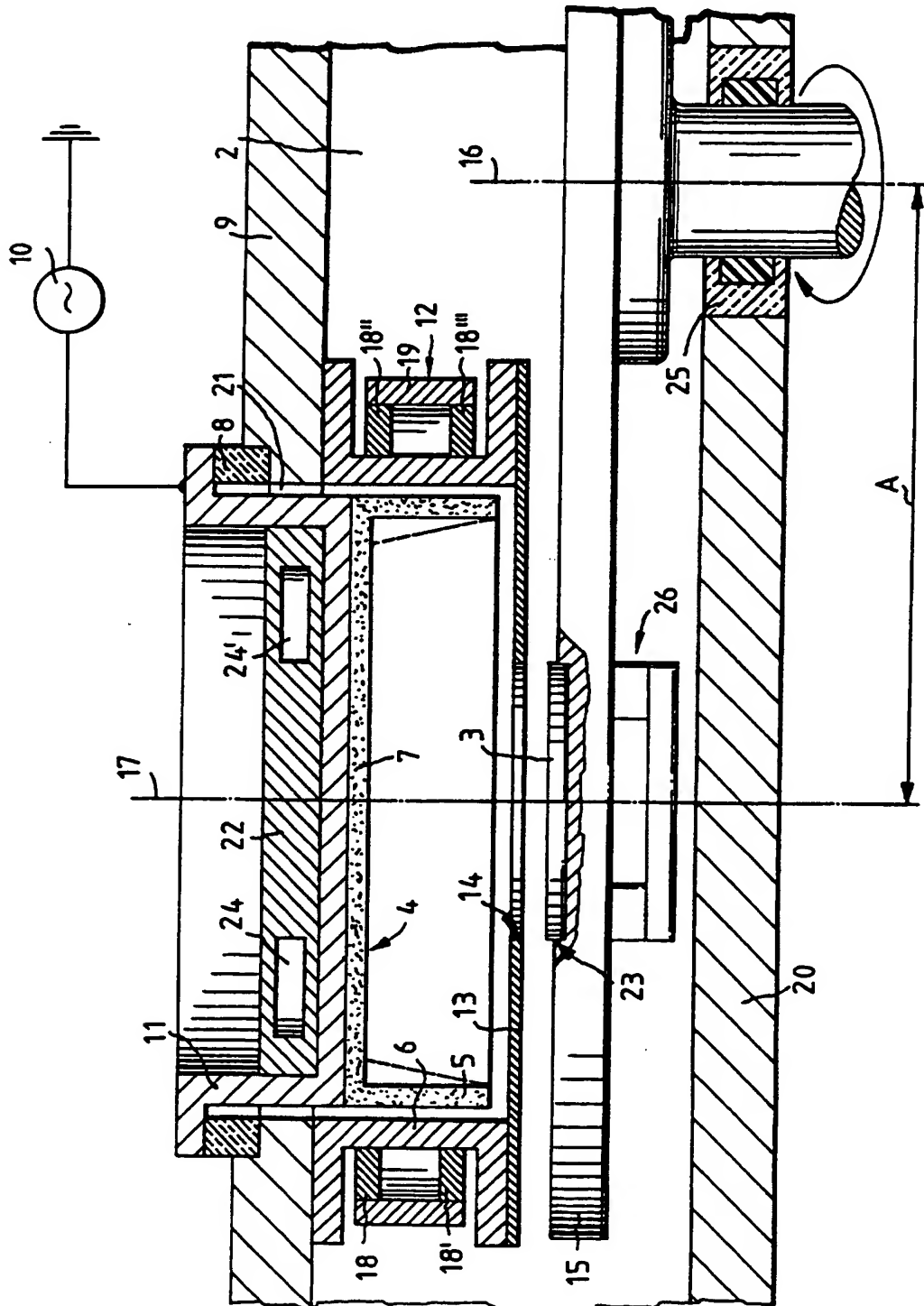
(57) In a device for coating substrates 3 by means of cathode sputtering with a hollow target 4 which is open towards the substrate 3 which is to be coated, a dark space shield 6 extending parallel to the side wall 5 of the target 4 and a basic cathode body 11 which is firmly connected to the bottom part 7 of the target 4, is supported at the wall 9 of the vacuum chamber 2 via an insulator 8 and is electrically connected to a power source 10, there are provided a magnet belt 12 which extends parallel to the dark space shield 6 and is formed from a plurality of magnets 18, 18', ..., a diaphragm 13 which is held by the dark space shield 6 and has a centre opening 14, and a stationary, yet rotatably mounted rotary plate 15 for holding the substrate 3, the axis of rotation 16 of which plate is staggered by a dimension A with respect to the perpendicular plane of symmetry 17, which extends parallel to it, of the target 4.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1995

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**Device for coating substrates by means of cathode sputtering with a hollow target**

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The invention relates to a device for coating substrates by means of cathode sputtering with a hollow target which is open towards the substrate which is to be coated.

A known arrangement for coating substrates by means of cathode sputtering (DE 35 06 227 C2) has a cathode which is in the shape of a hollow body and is open towards the substrate to be coated and an anode, wherein a magnet system is provided on the outside of the hollow body-shaped cathode which is distant from the substrate to establish the sputtering zone on the inside of the cathode, and wherein the magnet system is formed such that during operation two sputtering zones are produced on the inside of the cathode which is to be sputtered and the relation between the sputtering capacities of the two sputtering zones is adjustable. The hollow body-shaped cathode has the shape of a hollow cylinder which is open on one side, and a first sputtering zone is essentially restricted to the inner cylindrical surface area and a second sputtering zone to the closed end face of the cylinder.

The particular advantage of this known arrangement lies in an improved progressive coverage without any reduction in the homogeneity of the layer thickness.

Also known is a coating device (EP 0 459 413 A2) in which the substrate is disposed on a rotary plate and during the

coating operation moves through under two targets which are both connected to a RF source and, being separated from one another by a diaphragm, held stationary opposite the rotary plate. The known coating device is primarily used to produce magnetic recording layers consisting of a stack of layers which are formed alternately from a Co and a Pt or Pd layer.

The object of the invention is to provide a sputtering source which has a comparatively simple structure, can therefore be inexpensively produced and permits low-energy deposition, with the individual layers and their interfaces exhibiting the fewest possible defects and least possible radiation damage and remaining free of inert gas pockets. It should also be possible to deposit the layers as MR/GMR layers (magnetoresistive / gigantomagnetoresistive) and these should be particularly suitable for thin-film heads.

This object is solved according to the invention by a dark space shield extending parallel to the side wall of the target and a basic cathode body which is firmly connected to the bottom part of the target, is supported at the wall of the vacuum chamber via an insulator and is electrically connected to a power source, and with a magnet belt which extends parallel to the dark space shield and is formed from a plurality of magnets, a diaphragm which is held by the dark space shield and has a centre opening, and a stationary, yet rotatably mounted rotary plate for holding the substrate, the axis of rotation of which plate is staggered by a dimension with respect to the plane of symmetry, which extends parallel and perpendicularly to it, of the target.

Further particulars and features are described in detail and characterised in the subclaims.

The invention permits a wide variety of possible embodiments; one of these is represented diagrammatically in detail in the accompanying drawing, which is a sectional view of a coating device.

The device consists essentially of a basic cathode body 11, which is held in an opening 21 in the upper wall part 9 of the vacuum chamber 2 and is supported on an insulating ring 8, with a cooling body 22, which is inserted in the cathode body 11, and a pot-shaped target 4, which is soldered to the basic cathode body 11 and has a circular cylindrical side wall part 5, a dark space shield 6, which surrounds the side wall part 5 at a spacing and has a U-shaped cross-sectional area, a magnet belt 12, which consists of a plurality of individual permanent magnets 18, 18', ... and an annular yoke 19, and a rotary plate 15, which is rotatably mounted in the lower wall part 20, with substrates 3, 3', ... held in cavities 23, 23', ... at its circular disc-shaped upper surface.

After the vacuum chamber 2 has been pumped out and a suitable process gas admitted, for example argon, the rotary plate 20 is rotated, so that the individual substrates 3, 3', ... move through under the diaphragm opening 14 one after the other and are coated by the material particles driven out of the target 4. The individual parameters, such as, e.g. the speed of rotation of the rotary plate and the applied current, are selected so that a uniform and homogeneous layer is deposited on the substrates 3, 3', ... In order to prevent the target 4 from overheating, the basic cathode body 11 is provided with the cooling body 22, the cooling channels 24, 24', ... of which are connected to a cooling liquid source, which is not shown in detail. The circular cylindrical inner surface of the side wall part 5 of the target 4 may be replaced by a slightly conical inner surface, as indicated in the drawing by a broken line.

A magnet arrangement 26 is advantageously provided on the underside of the rotary plate 15 in the region of the cavity 23 for the substrate 3.

## List of reference numbers

2	vacuum chamber
3, 3', ...	substrate
4	target
5	side wall
6	dark space shield
7	bottom part
8	insulator
9	wall part
10	power source
11	basic cathode body
12	magnet belt
13	diaphragm
14	centre opening
15	rotary plate
16	axis of rotation
17	plane of symmetry
18, 18', ...	magnet
19	magnet yoke
20	wall part
21	opening
22	cooling body
23, 23', ...	cavity
24, 24', ...	cooling bore
25	sleeve
26	magnet arrangement

## Claims

1. Device for coating substrates (3) by means of cathode sputtering with a hollow target (4) which is open towards the substrate (3) which is to be coated, a dark space shield (6) extending parallel to the side wall (5) of the target (4) and a basic cathode body (11) which is firmly connected to the bottom part (7) of the target (4), is supported at the wall (9) of the vacuum chamber (2) via an insulator (8) and is electrically connected to a power source (10), and with a magnet belt (12) which extends parallel to the dark space shield (6) and is formed from a plurality of magnets, a diaphragm (13) which is held by the dark space shield (6) and has at least one opening (14), and a stationary, yet rotatably mounted rotary plate (15) for holding the substrate (3), the axis of rotation (16) of which plate extends parallel to the plane of symmetry (17) of the hollow target (4).
2. Device according to claim 1, characterised in that the substrate (3) is held by the rotary plate (15) directly below the diaphragm (13) and opposite the bottom part (7) of the target (4), the dimensions of the opening (14) in the diaphragm (13) corresponding approximately to those of the substrate (3).
3. Device according to claims 1 and 2, characterised in that the radially inner side wall surface of the target (4) extends at an inclination to the perpendicular plane of symmetry (17).
4. Device according to one or more of the preceding claims, characterised in that the rotary plate (15) is held by a sleeve (25) of an electrically insulating material which permits the setting of a certain

electrical potential with respect to the parts forming the anode.

5. Device according to one or more of the preceding claims, characterised in that the diaphragm (13) is provided as a layer thickness distribution diaphragm with a diaphragm opening (14) which is adapted to the sputtering conditions.
6. Device according to claims 1 and 2, characterised in that the dark space shield (6) extending parallel to the target (4) has an approximately U-shaped cross-sectional profile, the portion of the dark space shield (6) which forms one limb being connected to a diaphragm (13) whose part (23) which faces the plane of symmetry (17) engages over the side wall part (5) of the target (4) in the radially inward direction.



# The Patent Office

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Application No: GB 9703784.0  
Claims searched: 1-6

Examiner: Peter Beddoe  
Date of search: 23 April 1997

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): C7F (FCAS, FCAV, FEAB); H1D DGQ

Int Cl (Ed.6): C23C (14/34, 14/35); H01J 37/34; H05H 1/46

Other: Online: WPI

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	EP 0612097 A1 (LEYBOLD) see esp claim 1 & fig	1
A	GB 2157715 A (BALZERS) see whole doc	
A	US 5423971 (LEYBOLD) see whole doc	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.